THE WARFARE AGAINST TUBERCULOSIS.

BY MAZYCK P. RAVENEL, M.D.

(*Read April 4, 1903.*)

It would seem almost superfluous to dwell on the terrible destruction of human life due to tuberculosis, or to dilate on the urgent necessity that exists for general and combined efforts to lessen its ravages; yet, in spite of all that has been said and written on the subject during the last ten years, and in spite of certain encouraging signs of awakening interest in the public mind, it is still true that there exists a lamentable and inexplicable apathy in regard to this scourge of the human race. Philanthropists are lavish in their gifts to colleges, hospitals, libraries, museums and such like institutions, yet in America at least there have been very few substantial donations toward the eradication of tuberculosis, though it would be hard to imagine a greater boon to stricken humanity than the accomplishment of this end. Legislators give freely to all kinds of charitable institutions, but the amount given to the army of the tuberculous is pitiably small. This attitude of legislators may to a great extent be taken as indicative of public sentiment. This sentiment becomes harder to understand when we consider that three facts have been absolutely demonstrated in regard to the disease: 1. It is communicable. 2. It is preventible. 3. In the early stages it is curable.

It is well to inquire into the causes of this lack of interest, and see if there is sound reason for them. One of the greatest drawbacks has been the persistent belief in the hereditary character of the disease, which is even now quite prevalent among the masses, and held by many physicians. While it has been shown that tuberculosis may be transmitted in this manner, it has been equally proven that it is of very rare occurrence, and practically negligible. Among the lower animals healthy offspring may be constantly obtained from tuberculous mothers by separation at birth and artificial feeding—a plan carried out on a large scale in Denmark by Prof. Bang. It is, however, true that tuberculosis runs in families, the reason being that the children of phthisical parents are constantly exposed to infection. In man only some twenty cases of true hereditary tuberculosis are on record (Osler), and in cattle there are less than 100 to be found in the literature. Another obstacle to progress is the inevi-

table tendency of the human mind to grow accustomed to danger. We have grown accustomed to the death-rate from tuberculosis, and do not realize what it means. A panic would be caused in any one of our large cities by 100 deaths from cholera, yellow fever or plague, yet in New York 10,000 deaths and in Philadelphia 2800 deaths are caused each year by tuberculosis without exciting even passing comment from the average person. The only real difference is that tuberculosis is with us always, demanding its lion's share of victims with each recurring year, while the other diseases are rare visitors.

The total number of deaths in the United States each year from tuberculosis is estimated at 150,000, which means a money loss of $330,000,000 to the country. This should be sufficient reason for preventive measures on our part, even if we leave out of consideration the distress of the victims and their families. The slow and insidious onset of tuberculosis no doubt tends to lessen the fear we have of it, but in this very fact lies much danger, since it is more difficult to persuade persons of the relation of cause and effect than in a malady where exposure is promptly followed by attack. The magnitude of the task deters some from undertaking it. Very recently a legislator who was being urged to assist in procuring State aid brought up such an objection. The task is unquestionably a great one, but it can be stated with assurance that the total eradication of tuberculosis is feasible.

Another class of obstructionists are those persons who regard all discoveries as "new-fangled notions," and quote the mode of life of their grandfathers, who did not find measures for the prevention of tuberculosis necessary. It is impossible to argue with such persons, as a rule. It may be pointed out, however, that tuberculosis is essentially a disease spread by overcrowding, and, like all communicable diseases, the more dense the population the greater necessity for preventive measures. Conditions change materially with increase of population, and the new conditions must be met by new measures which may have been unnecessary before.

Prevention of Tuberculosis.

All efforts at the eradication of tuberculosis to be successful must be based on the fundamental fact of its communicability, and in the main it is to be treated as the other contagious diseases, though

the restrictions need not be so severe, since more or less prolonged exposure is necessary to bring about infection.

Two parties are to be considered, the tuberculous person and the community, and while the former is entitled to every consideration and attention, the good of society in general must be the principal consideration which guides our actions. Fortunately, the interests of the two parties are not irreconcilable, and much can be done by education to smooth the difficulties which lie in our path. With this end in view there should be in every State, and in all large cities, societies whose object is the study of methods of prevention, and the dissemination of such knowledge in short, plainly written tracts among the people. In addition to this, Boards of Health should issue circulars constantly giving such information and advice. At present only twenty-two States and seven cities issue such circulars and recommendations, while five States have State societies and five cities have local societies for the prevention of tuberculosis. These societies can do much good also by shaping legislation. States and cities should have uniform laws regarding expectoration in public conveyances, buildings and on sidewalks, overcrowding of factories and tenement-houses, the construction of such buildings as regards light and ventilation, and the employment of children under age. Health officers should have the power to force ignorant and vicious tubercular persons who persist in reckless expectoration and other offenses against public hygiene into hospitals provided for them by the public. There should be notification and registration of the persons suffering from phthisis, and apartments occupied by such persons should be thoroughly disinfected periodically, and always after death or vacation of the premises before new tenants are allowed to enter them.

All of these things can be carried out with little or no increase of expense, and much good can be accomplished along these lines. However, the urgent need is for institutions in which the sick can be cared for and instructed. These should be of at least two types :— sanatoria, built in open country districts in regions known to be specially adapted to the treatment of tuberculosis; and, second, hospitals in or near cities for the hopelessly ill and destitute, where the maximum of comfort can be given them, and where they will cease to be sources of infection to their families and the public in general. In connection with the sanatoria convalescent farms are most useful, and may be made self-sustaining to a certain extent. On

such farms patients who are well enough to be discharged from the sanatoria can find light employment under good conditions until strong enough to return to their usual avocations in factories, etc., without danger of relapse.

I have not tried to outline an ideal method of dealing with tuberculosis, and much could be added to what has been said, but have limited myself to what appears to me imperatively demanded by the conditions which confront us, and to what is entirely in our power to effect. The affair is, however, beyond private charity, and governmental aid is necessary, each State doing its share.

In spite of the enormous expenditure which would be involved in providing hospital accommodations for the indigent tuberculous, it would cost less than the present money loss to the country from deaths alone, estimated, as said before, at $330,000,000 annually; and in a few years we could confidently expect a marked and progressive decrease in outlay. It must be borne in mind that the demonstration of the communicability of tuberculosis has resulted in special hardships to the poor consumptive, since most general hospitals now close their doors to these afflicted ones. The poor consumptive reaps but little aid from the vast donations from public and private sources to general hospitals; hence the urgent necessity for special provision for them, both on the score of humanity as well as protection to the public health.

Hand in hand with such measures should go efforts directed to the eradication of tuberculosis from cattle, since we must look on cattle as the source from which a certain amount of human tuberculosis springs, chiefly in children.

Without entering into matters of controversy, the following proven facts may be stated as grounds for this belief:

(1) The tubercle bacillus as found in bovine animals differs from that found in man chiefly in its greater virulence for practically all experimental animals, including man's nearest relative, the monkey. It would be an anomaly if man, one of the most susceptible of all animals to tuberculosis, were immune to the most powerful type of the germ of tuberculosis known to us.

(2) There are numerous well-authenticated cases of accidental inoculation of man by the bovine tubercle bacillus, with the production of typical disease at the point of inoculation. Some of these cases have been followed by general tuberculosis, ending in death, attributable with good reason to the inoculation.

(3) A number of instances have been recorded in which the onset of tuberculosis followed the use of milk from tuberculous cows. In some of these the relation of cause and effect is so close that Nocard has well said "they have almost the value of an experiment."

(4) That food containing bovine tubercle bacilli may and does produce tuberculosis in man seems already proven by finding in the intestinal tract (mesenteric glands) of children who have died of tuberculosis tubercle bacilli which have all the characteristics of the bovine germ, and which have an intense degree of virulence for cattle.

(5) The close relationship of the human and bovine tubercle bacilli has been shown by the recent experiments in immunization, in which it has been proven that injections of bacilli from human sources will protect animals against virulent bovine germs. This has been done by Trudeau, De Schweinitz, and Pearson and Gilliland in this country, and by Behring and Thomassen in Europe.

What Has Been Done in the United States Toward the Suppression of Tuberculosis.

Three States and four cities require the reporting of cases of tuberculosis; in five States and five cities report is optional; in one city it is under litigation.

Two States have general anti-spitting laws, while five States have local laws, and fourteen cities have their own laws. Twenty-two States and seven cities issue circulars and recommendations.

The United States Government has two sanatoria for persons in its employ; five States have five special institutions, and nine States have projected sanatoria. Two States have tent colonies on a small scale. Only three cities have special municipal hospitals for consumptives. There are forty-two private institutions in eleven States, some supported by private charity, some partially self-supporting, and some for pay patients only.

Twenty States and twelve cities have laws regarding bovine tuberculosis. Twenty States have done nothing in regard to human or bovine tuberculosis; six States have done something to combat tuberculosis in man only, and eight States have done something against bovine tuberculosis alone.[1]

[1] These figures have been taken almost entirely from the valuable paper of Dr. S. A. Knopf, read before the American Medical Association at Saratoga, June, 1902. Since then considerable advance has been made.

Comparisons are said to be odious, but in the hope of stirring up our people in the United States, I quote the most recent statistics of what is being done in Germany, which may be taken as an index of the attitude of most of the countries of Europe toward the scourge of tuberculosis.

The Fight Against Tuberculosis in Germany.

According to the Imperial Health Office in Berlin, the deaths from tuberculosis are about one-tenth of those of all diseases. In 1899 the number of patients treated in hospitals in the empire was 226,000. According to the latest statistics there are at present 57 public sanatoriums for the tuberculous in Germany, of which 34 are located in Prussia, 6 in Bavaria, 2 in Saxony, 1 in Wurtemberg, 1 in Hessen, 1 in Sachsen-Weimar, 1 in Thuringia, 1 in Reichsland, 3 in Baden, 2 in Brunswick and 5 in the Hansa cities. Besides these there are 4 four institutions near the sea—namely, Nordeney, Wyk, Gross-Muritz, Zoppot. There are also 23 public sanatoriums nearly completed, among these being Buch, near Berlin. The city of Berlin has at the present time 3 public sanatoriums—namely, Malchow, Blankenfelde, Gutergotz. There are also 20 private German sanatoriums, and 1 in Davos (Switzerland). In the 78 sanatoriums for the tuberculous there are 7000 beds. If we calculate that each bed is used by four persons in the course of a year, we find that about 30,000 tuberculous patients annually enjoy the benefit of treatment in the sanatoriums. The efforts made in the German Empire to combat tuberculosis, both by direct regulations and by general preventive measures, are being actively carried on. In particular, the Imperial Government, the governments of the different States, the executive authorities, the national insurance institutions and the municipal governments are seriously and actively participating in this work. The result of these efforts, which have been now carried on for some years, is already noticeable in a decrease in the number of deaths from tuberculosis, which in the future will be still more marked (*American Medicine*, March 21, 1903).

Artificial Immunity and Serum-Therapy.

For many years constant effort has been made to discover a serum or lymph for the specific treatment of tuberculosis, and several such substances have been announced from time to time. All of them

have proved disappointing, however, not excepting Koch's lymph or tuberculin, the discovery of which was hailed with delight and enthusiasm by physicians and consumptives alike in all parts of the world. Recently it has been demonstrated authoritatively that it is perfectly possible to produce artificial immunity against tuberculosis in animals by a process of vaccination, as such methods are now generally termed, and with this demonstration comes the well-founded hope that we are within sight of the goal so much hoped for, the discovery of a specific serum for the cure and prevention of tuberculosis. Indeed, we have already the news that two well-known bacteriologists have produced such a substance. While the details have not yet been made public, the names of these two men, Behring, of Germany, the discoverer of diphtheria antitoxin, and Marmorek, of the Pasteur Institute, in Paris, the discoverer of streptococcus antitoxin, are of such weight as to justify strong hope that they have achieved success. We may feel assured that marked progress has been made, to say the least.

I have not dwelt on the pathetic side of this question—the fearful loss of life and suffering entailed by a preventable disease. On this point I cannot do better than to quote a short editorial from a recent issue of *American Medicine* (March 28, 1903). While this deals with the city of New York, it is equally applicable to every city in the United States, the figures only needing modification.

The Tragedy of the Homeless and Friendless.

"In the year 1902, in the borough of Manhattan, there died of tuberculosis, chiefly in the various hospitals of the city, 1787 patients. Of these, 950 were "not known" at the addresses given; 456 gave no addresses; 275 gave the address of a lodging-house, and 106 gave an address outside of the city. It must be remembered that these deaths constituted only about one-seventh of all the deaths that took place. Moreover, for every death there are, according to Dr. Farr, about two years of illness endured. When one thinks how much our happiness, even in health, depends upon home and love and friendship, and that in illness and death the blessedness of these things is vastly increased, and then when one realizes that there are so many thousands of the sick and dying in our cities utterly homeless and friendless, the pity of it all becomes indeed terrible. The tragedy of obviable disease and needless

death kindles our zeal to stop the spread of infection, to discover the means of preventing the suffering, and, when this is not possible, to surround the lonely sick and dying with the best medical skill, attention and kindness that is possible. The desolation of their appalling loneliness is often doubtless greater than that of their illness and oncoming death combined."

PHILADELPHIA, April 4, 1903.

ON ARTIFICIAL PRODUCTION OF CRYSTALLIZED DOMEYKITE, ALGODONITE, ARGENTODOMEYKITE AND STIBIODOMEYKITE.

(Plate V.)

BY GEORGE A. KOENIG.

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In a paper on mohawkite, domeykite and other copper arsenides of the Mohawk mine (*Zeitsch. f. Krystall.*, etc., Vol. xxxiv, 1 Heft), I mentioned some attempts made by me to obtain domeykite in measurable crystals by the action of arsenic vapors upon metallic copper. One experiment gave crystals, although not measurable, but further trials failed at the time, evidently through my inability to maintain the proper temperature by means of an Erlenmeyer combustion furnace. The range between the temperature at which the crystals form and that at which the crystals melt is a very narrow one. On the other hand the eagerness with which the copper absorbs the arsenic causes heat, and hence the difficulty in adding just the right quantity of thermal energy from the outside. It occurred to me to try an electric current as a source of heat. The very first trial gave most promising results. The experiments were taken up in November, 1900, and continued until March, 1901. The adjoining figure illustrates the simple apparatus which proved itself adequate to all requirements.

In watching the rapid growth of the crystals the similarity of the phenomenon with the development of an egg occurred to me, and I applied the name "incubator" to the apparatus, than which no other could be more expressive.